Atmospheric Aerosol Analysis using Lightweight Mini GC

Seacoast Science, Inc.

Technical Abstract
The major components of manmade aerosols are created by the burning of coal and oil. Aerosols are recognized to significantly impact the climate through their effects on solar and terrestrial radiation. Accurate speciation and measurement of aerosol composition is an important first step in understanding and managing these pollutants. This Phase II proposal continues development of a small, portable, detection system specifically for the collection, speciation and identification of gas phase and aerosolized organics. This Mini Gas Chromatograph collects samples and operates without the need for compressed-bottled gas by using Seacoast's proprietary chemicapacitive sensor array and commercial sensors with a preconcentration/chromatography system, combining selectivity from a diverse sensor array with a miniature sampling system for amplified sensitivity. Specific components are: 1) sample preconcentrator/collector capable of being heated quickly, 2) capillary column to separate the chemicals released from the preconcentrator and provide selectivity, 3) the chemical sensor array containing Seacoast's chemoselective microcapacitors and metal-oxide-based detectors, 4) integrated user interface. In Phase I Seacoast demonstrated that the system is capable of analyzing gas-phase and aerosolized volatile organics. In Phase II we propose to further develop the system's capabilities with a focus on improving sensitivity and collection efficiency.

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2009 Phase II
Proposal S1.08-9140

An Infrared Fiber-Optic Raman Sensor for Field Detecting of Organic Biomarkers

Crystal Research, Inc.

Technical Abstract
The search for organics on Mars remains a key objective for future missions. However current instruments for detailed organic analysis require complex sample handling and can process only a limited number of samples. To allow for rapid sample characterization, the in situ non-destructive Raman detection technique is a highly desirable sensing tool for both qualitative and quantitative analysis. However, current Raman systems deployed in the field are inadequate due to deleterious fluorescence interference. Fluorescence is often several orders of magnitude more intense than Raman scattering signals and its broad structures spectrum could be difficult to remove from Raman spectra. We propose to develop a rover-mounted infrared fiber-optic Raman sensor that can eliminate fluorescence with significantly improved Raman sensitivity for fast field detections. The infrared fiber-optic Raman sensor is based on recent technology advances in fiber lasers, fiber optic Raman probes and infrared detector arrays. Innovative infrared fiber-optic Raman sensor enables highly sensitive fluorescence-free Raman analysis and offers flexible remote detection, so that the field spectral sensor's overall performance would be intact and extremely flexible for planetary missions. We will deliver a rover-mounted infrared fiber-optic Raman sensor to NASA at the end of Phase II program.

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2009 Phase II
Proposal S1.09-9778